

## Body MR

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## Body MR - Protocols

Liver  
MRCP  
Pelvis

- Which sequences
- Why
- Normal & Abnormal

## Liver Protocol

- 2D Single-shot FSE/TSE - TE 60ms\*
- 2D Single-shot FSE/TSE - TE 160ms\*
- 2D Balanced T2w/T1w Gradient Echo\*
- 2D Resp Trig Multi-shot FSE/TSE
- 2D Dual Echo (I/O Phase) T1w GE\*
- 3D T1w Gradient Echo + 3 phase Gd\*

\* breath-hold sequences

## Before starting

- Fasting - no
- Breath-holding - yes
- Voluntary motion - no
- Coil Selection
- Initial Positioning
- Match slice locations where possible  
(e.g. 10/0 or 8/2 or 5/0)

## 2D Single-shot FSE/TSE - TE 60ms

For location/anatomy + T2 contrast

TE<sub>eff</sub> 60ms  
SSFSE  
half-Fourier  
256x256  
10/0mm  
BH on RT  
TR=1800  
Interleave

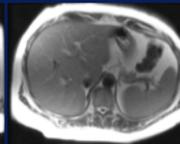
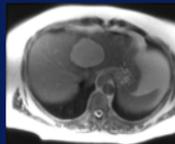


## 2D Single-shot FSE/TSE - TE 60ms

For localisation/anatomy & T2 contrast

HAEMANGIOMA

CYST

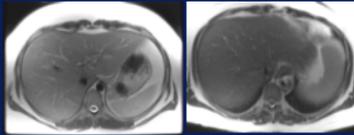


### 2D Single-shot FSE/TSE - TE 60ms

For localisation/anatomy & T2 contrast

ADENOMA

REGEN NODULE

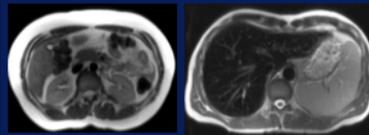


### 2D Single-shot FSE/TSE - TE<sub>eff</sub> 60ms

For localisation/anatomy & T2 contrast

FOCAL FAT

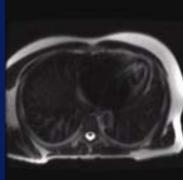
IRON



### 2D Single-shot FSE/TSE - TE<sub>eff</sub> 160ms

For cysts & haemangiomas

TE<sub>eff</sub> 160 ms  
SSFSE  
Half-Fourier  
256x256  
10/0mm  
SH or RT  
TR~1500  
Interleave

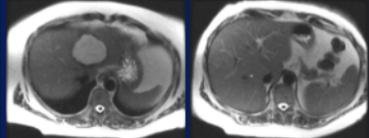


### 2D Single-shot FSE/TSE - TE 160ms

For cysts/haemangioma T2 contrast

HAEMANGIOMA

CYST

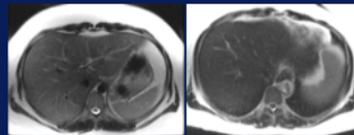


### 2D Single-shot FSE/TSE - TE 160ms

For cysts/haemangioma T2 contrast

ADENOMA

REGEN NODULE

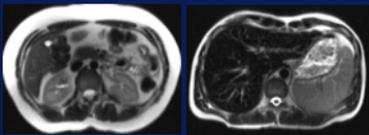


### 2D Single-shot FSE/TSE - TE 160ms

For cysts/haemangioma T2 contrast

FOCAL FAT

IRON



## 2D Resp Trig Multi-shot FSE/TSE

For lesion characterisation

TE<sub>eff</sub> 85 ms  
Multishot FSE/TSE  
ETL 13  
384x256  
ZIP 512x512  
8/2mm  
Resp Triggered  
4-6mins

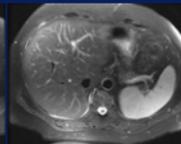
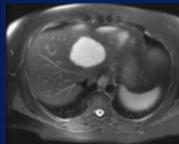


## 2D Resp Trig Multi-shot FSE/TSE

For lesion detection & characterisation

HAEMANGIOMA

CYST

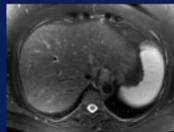
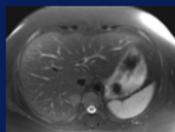


## 2D Resp Trig Multi-shot FSE/TSE

For lesion detection & characterisation

ADENOMA

REGEN NODULE



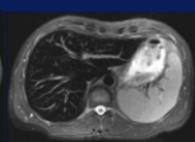
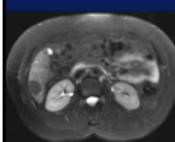
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## 2D Resp Trig Multi-shot FSE/TSE

For lesion detection & characterisation

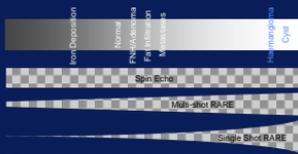
FOCAL FAT

IRON



## T2w Spin Echo Contrast Bias

Simplified T2 Spectrum of Liver Pathology



## 2D Balanced T2w/T1w Gradient Echo

For anatomy & vascular patency

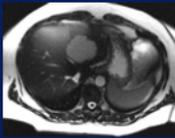
TE 1.5 ms  
TR 3.3 ms  
F1ESTA\*  
320x192  
ZIP 512x512  
8/2mm  
Breath-hold



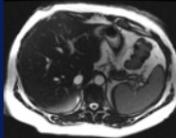
## 2D Balanced T2w/T1w Gradient Echo

For anatomy & vascular patency

HAEMANGIOMA



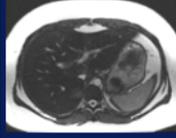
CYST



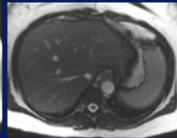
## 2D Balanced T2w/T1w Gradient Echo

For anatomy & vascular patency

ADENOMA



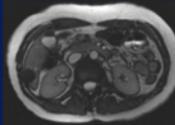
REGEN NODULE



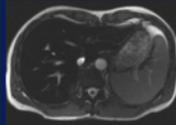
## 2D Balanced T2w/T1w Gradient Echo

For anatomy & vascular patency

FOCAL FAT



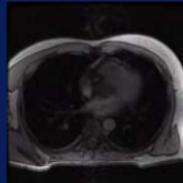
IRON



## 2D Dual Echo (I/O Phase) T1w GE

For T1w features & fat infiltration

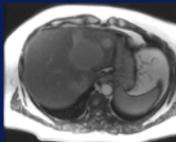
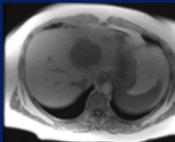
TE 2.2/4.4ms  
TR120-150ms  
F50G0/FLASH  
256x128  
10/0mm  
Breath-hold



## 2D Dual Echo (I/O Phase) T1w GE

For T1w features & fat infiltration

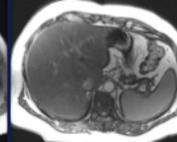
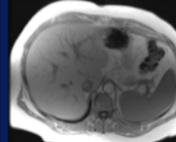
HAEMANGIOMA & DIFFUSE FAT  
IN PHASE OUT PHASE



## 2D Dual Echo (I/O Phase) T1w GE

For T1w features & fat infiltration

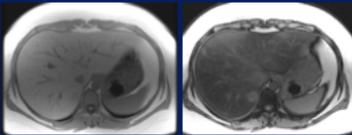
CYST & DIFFUSE FAT  
IN PHASE OUT PHASE



### 2D Dual Echo (I/O Phase) T1w GE

For T1w features & fat infiltration

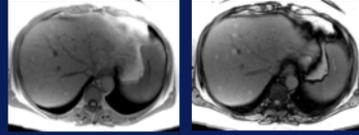
**ADENOMA & DIFFUSE FAT**  
IN PHASE      OUT PHASE



### 2D Dual Echo (I/O Phase) T1w GE

For T1w features & fat infiltration

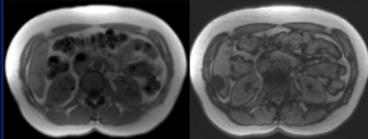
**REGEN NODULE**  
IN PHASE      OUT PHASE



### 2D Dual Echo (I/O Phase) T1w GE

For T1w features & fat infiltration

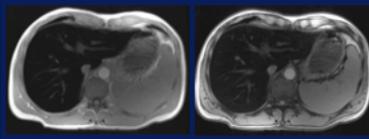
**FOCAL FAT**  
IN PHASE      OUT PHASE



### 2D Dual Echo (I/O Phase) T1w GE

For T1w features & fat infiltration

**IRON**  
IN PHASE      OUT PHASE



### 3D T1w Gradient Echo + 3 phase Gd

For lesion detection & characterisation

TE 1.8 ms  
TR 3.9 ms  
3DT1w  
"LAVA"  
Fat Suppressed  
ZIP 512x512  
5/0  
Interp 2.5  
BH



PRE

### 3D T1w Gradient Echo + 3 phase Gd

For lesion detection & characterisation



ARTERIAL

### 3D T1w Gradient Echo + 3 phase Gd

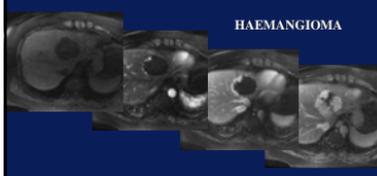
For lesion detection & characterisation



PORTAL

### 3D T1w Gradient Echo + 3 phase Gd

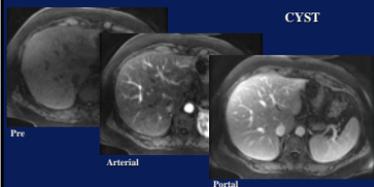
For lesion detection & characterisation



HAEMANGIOMA

### 3D T1w Gradient Echo + 3 phase Gd

For lesion detection & characterisation



CYST

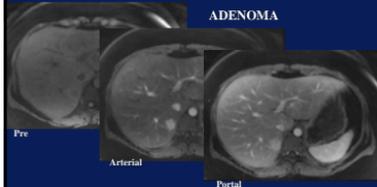
Pre

Arterial

Portal

### 3D T1w Gradient Echo + 3 phase Gd

For lesion detection & characterisation



ADENOMA

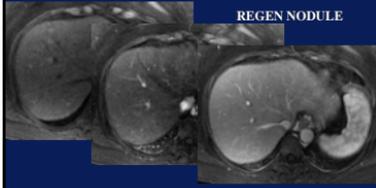
Pre

Arterial

Portal

### 3D T1w Gradient Echo + 3 phase Gd

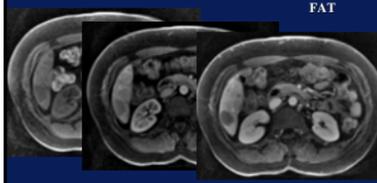
For lesion detection & characterisation



REGEN NODULE

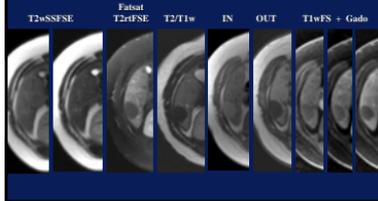
### 3D T1w Gradient Echo + 3 phase Gd

For lesion detection & characterisation



FAT

## Consistency Checking



## MRCP Protocol

- 2D T2w single-shot FSE/TSE - TE 60ms<sup>\*</sup>
- 2D T1w Spoiled Gradient Echo<sup>\*</sup>
- 2D Thick axial long TE ss FSE/TSE<sup>\*</sup>
- 2D Thick coronal long TE ss FSE/TSE<sup>\*</sup>
- 2D Thin section long TE ss FSE/TSE<sup>\*</sup>
- 3D Resp-trig long TE ms FSE/TSE

<sup>\*</sup> breath-hold sequences

## MRCP: Before Starting

- Fasting - Yes
- Oral Contrast Media - No

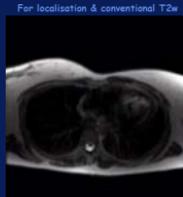
## 2D T2w single-shot FSE/TSE - TE 60ms

TEeff 60 ms  
SSFSE  
Half-Fourier  
256x256  
10/0mm  
BH or RT  
TR-1500  
Interleave



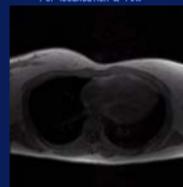
## 2D T2w single-shot FSE/TSE - TE 60ms

TEeff 60 ms  
SSFSE  
Half-Fourier  
256x256  
10/0mm  
BH or RT  
TR-1500  
Interleave



## 2D T1w Spoiled Gradient Echo

TE 4.4ms  
TR 150ms  
FSPGR/FLASH  
256x128  
10/0mm  
BH  
Interleave



## 2D Thick section long TE ss FSE/TSE

For bile duct finding & localisation

TEeff 600ms  
SSFSE  
Full-Fourier  
Fat Suppression  
256x256  
40/0mm  
BH or RT  
TR~2000



## 2D Thick section long TE ss FSE/TSE

For biliary tree demonstration

TEeff 800 ms  
SSFSE  
Full-Fourier  
Fat Suppression  
256x256  
40mm  
FOV 26cm  
BH or RT  
TR~8000  
Repeat x 3



## 2D Thick section long TE ss FSE/TSE

For biliary tree demonstration

TEeff 800 ms  
SSFSE  
Full-Fourier  
Fat Suppression  
256x256  
40mm  
FOV 26cm  
BH or RT  
TR~3000  
Repeat x 3



## 2D Thick section long TE ss FSE/TSE

For biliary tree demonstration

TEeff 800 ms  
SSFSE  
Full-Fourier  
Fat Suppression  
256x256  
40mm  
FOV 26cm  
BH or RT  
TR~3000  
Repeat x 3



## 2D Thin section long TE ss FSE/TSE

For biliary tree demonstration

TEeff 455 ms  
SSFSE  
Full-Fourier  
Fat Suppression  
256x128  
3/1  
BH or RT  
TR~1300  
12 sections



## 3D Resp-trig long TE ms FSE/TSE

For biliary tree demonstration

TEeff 570 ms  
FRFSE  
Fat Suppression  
Half-Fourier  
256x192  
ZIP512x512  
1.6mm  
Interp 0.8  
FOV 34cm  
RT  
TR~4000  
3-4mins



### 3D Resp-trig long TE ms FSE/TSE

For biliary tree demonstration



MIP

### 2D Thick section long TE ss FSE/TSE

Choledocholithiasis



### 2D Thick section long TE ss FSE/TSE

Choledocholithiasis



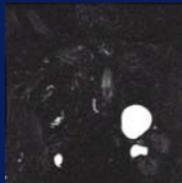
### 2D Thick section long TE ss FSE/TSE

Choledocholithiasis



### 2D Thin section long TE ss FSE/TSE

Choledocholithiasis



### 3D Resp-trig long TE ms FSE/TSE

Choledocholithiasis



3D Resp-trig long TE ms FSE/TSE

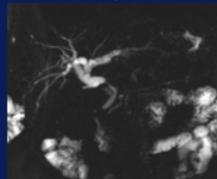
Choledocholithiasis



MIP

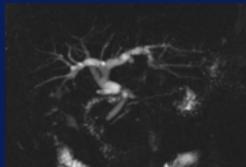
2D Thick section long TE ss FSE/TSE

Post Liver Transplant Stricture



2D Thick section long TE ss FSE/TSE

Post Liver Transplant Stricture



2D Thick section long TE ss FSE/TSE

Post Liver Transplant Stricture



2D Thin section long TE ss FSE/TSE

Post Liver Transplant Stricture



3D Resp-trig long TE ms FSE/TSE

Post Liver Transplant Stricture



## *Pelvis Protocol*

- 2D T2w single-shot FSE/TSE
- 2D T1w SE or GE
- 2D fat sat FSE/TSE
- 2D FSE/TSE (sagittal)
- 2D T1w SE/GE for PA nodes / kidneys
- 2D T2w ms FSE/TSE oblique

## *Pelvis: Before Starting*

- Fasting - ?
- Half full bladder - Yes
- Coils - multi-channel

## 2D T2w multi-shot FSE/TSE - TE 85ms

TE<sub>eff</sub> 85 ms  
TR 4500ms  
Multishot FSE/TSE  
Fat Suppression  
ETL 16  
384x256  
FOV 24cm  
ZIP 512x512  
5/2.5mm  
5 mins

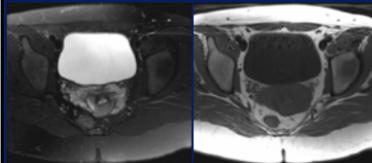


## 2D T1w SE

TE 16 ms  
TR 700ms  
T1w Spin Echo  
384x256  
FOV 24cm  
ZIP 512x512  
5/2.5mm  
5 mins



## Axial Slice Matching



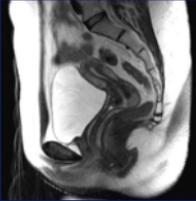
## 2D T2w multi-shot FSE/TSE - TE 85ms

TE<sub>eff</sub> 85 ms  
TR 4500ms  
Multishot FSE/TSE  
ETL 16  
384x256  
FOV 24cm  
ZIP 512x512  
5/2.5mm  
5 mins



2D T2w multi-shot FSE/TSE - TE 85ms

Fatsat



2D T1w SE

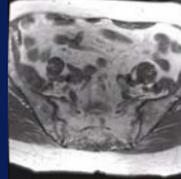
Body Coil  
to save any  
repositioning  
Or use T1w GW  
with a full array coil



2D T2w multi-shot FSE/TSE - TE 85ms



2D T1w SE



2D T2w - oblique - FSE/TSE - TE 85ms



2D T2w multi-shot FSE/TSE - TE 85ms

Fatsat



2D T2w multi-shot FSE/TSE - TE 85ms



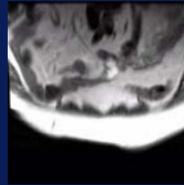
2D T1w SE



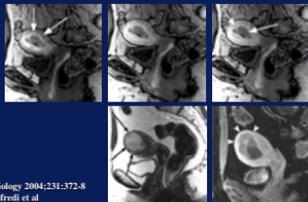
2D T2w multi-shot FSE/TSE - TE 85ms



2D T2w - oblique - FSE/TSE - TE 85ms



Pelvis: ? Gadolinium



Radiology 2004;231:372-8  
Manfredi et al

Summary

Principles  
to  
Protocols